

**Before the  
Federal Communications Commission  
Washington, DC 20554**

In the Matter of

Revision of Parts 2 and 15 of the  
Commission's Rules to Permit Unlicensed  
National Information Infrastructure (U-NII)  
Devices in the 5 GHz band

ET Docket No. 03-122  
RM-10371

**REPLY COMMENTS OF MOTOROLA, INC.**

Motorola, Inc. ("Motorola"), respectfully submits these reply comments in support of the FCC's Notice of Proposed Rulemaking ("NPRM") in the above proceeding.<sup>1</sup> The opening round of comments demonstrates convincingly the need for additional U-NII spectrum to support the growth of unlicensed wireless communications.<sup>2</sup> Not surprisingly, the vast majority of commenting parties, including Motorola, urge the Commission to move swiftly towards completion of a Report and Order ("R&O"). Motorola respectfully requests that the promulgated rules incorporate the minor clarifications presented in Motorola's comments, which many other parties support.

Motorola appreciates the tremendous efforts of the Federal Government agencies that worked to shape the recently approved U.S. proposals for the World Radiocommunication Conference 2003 ("WRC-03"). The Commission, NTIA, DoD and NASA clearly recognize the

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<sup>1</sup> FCC 03-110, rel. June 4, 2003 ("NPRM").

<sup>2</sup> See Comments of Cisco Systems, Inc.; Comments of The License-Exempt Alliance at 2; Comments of Microsoft Corp; Comments of Proxim Corp.; Comments of the Telecommunications Industry Assoc.; Comments of Towerstream Corp. See also NPRM ¶¶ 11-12.

wide-ranging public benefits that will flow from timely authorization of the proposed rules to provide an additional 255 MHz of spectrum at 5 GHz for U-NII operations. The additional spectrum will permit more robust broadband wireless deployments and enhanced data connectivity. Once available, Motorola will use the additional spectrum for a variety of applications, including service enhancements to its 5 GHz unlicensed wireless Canopy™ system.<sup>3</sup>

**I. The Proposed Requirements, Including the Interference Avoidance Mechanisms, Will Enable Successful Spectrum Sharing In The Newly Expanded U-NII Mid-band.**

**A. Transmit Power Limits**

Many parties, aside from Motorola, supported the FCC's proposal to apply the rules governing the middle 5.25-5.35 GHz U-NII band to the proposed 5.470-5.725 GHz band, including the 1 W EIRP power limit.<sup>4</sup> Motorola explained in its opening comments that the proposal allows for shorter distance applications such as those provided by Motorola's Canopy system, which can support links of up to two (2) miles at 1 W EIRP.

These same parties, however, expressed concern with the FCC's statement that the 100 MHz currently available for higher power operations is sufficient.<sup>5</sup> Echoing concerns expressed by Motorola, these parties explain that the 1 W EIRP power level is not able to meet the demands of Wireless Internet Service Providers (WISPs) offering larger cell deployments and backhaul transport. Motorola's Canopy system, for example, currently provides higher

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<sup>3</sup> Motorola's Canopy™ system provides broadband wireless services to residential communities and educational campuses alike. Information on the Canopy system, including detailed technical specifications, are available on Motorola's website at <<http://motorola.canopywireless.com/>>.

<sup>4</sup> See Comments of Cisco Systems, Inc.; Comments of Microsoft Corp. at 9; Comments of IEEE 802 at 7.

<sup>5</sup> See Comments of Cisco Systems, Inc. at 3-4; Comments of Proxim Corp.; Comments of Microsoft Corp. at 9; Comments of IEEE 802 at 7.

powered unlicensed operations using the U-NII high-band at 5.725-5.825 GHz; 4 W EIRP for point-to-multipoint applications and 200 W EIRP for point-to-point applications are permitted in this band. Because the higher-powered 5.725-5.825 GHz U-NII band is increasingly being used to provide broadband services in rural locations, it is becoming congested.

The Commission should consider undertaking further analyses with higher power systems to determine whether operations within the newly expanded mid-band in excess of 1 W will allow for successful spectrum sharing. The rules proposed in the NPRM were based solely upon analyses with devices operating at power levels of 1 W EIRP or less. If the results of future studies prove positive, the Commission should permit higher power unlicensed operations in the new 5.47-5.725 GHz U-NII band. In the event these studies indicate the new band cannot support higher power operations, the Commission should allocate additional spectrum for such operations.

#### **B. Point-to-Point Operations in the New Mid-Band**

Motorola recognizes that the initial spectrum sharing studies performed in preparation of the U.S. position for the WRC-03 conference used unlicensed devices operating in a point-to-multipoint configuration, *i.e.*, with omni directional antennas.<sup>6</sup> These studies did not expressly account for situations where U-NII devices are operating in a point-to-point configuration, *i.e.*, with antenna discrimination in the direction of the radar. For these reply comments, Motorola has analyzed specifically this point-to-point configuration and provides the results in an Appendix to these reply comments.

The Appendix illustrates that point-to-point operations should be permitted in the new mid band allocation at 5475-5725 MHz and continue to be permitted in the current 5250-

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<sup>6</sup> See Appendix 2 of Annex 6 to ITU-R Recommendation M.1652.

5350 MHz mid band, as the DFS with Radar Detection mechanism will operate in the same manner in point-to-point configurations as with point-to-multipoint configurations – providing the same level of protection to incumbent radar systems. While the NPRM does not explicitly address this issue of point-to-point operation versus point-to-multipoint operation, Motorola respectfully requests that the promulgated rules do not unnecessarily limit point-to-point operation in the newly expanded 5470-5725 MHz band.

### **C. Dynamic Frequency Selection (“DFS”) Requirements**

An overwhelming majority of parties supported the FCC’s proposals to implement DFS with Radar Detection and TPC to allow for spectrum sharing with incumbent radar systems.<sup>7</sup> With regard to the Commission’s proposed definitions, several parties agreed with Motorola that the concept of Radar Detection should be defined separately from DFS, as the two concepts represent separate functions.<sup>8</sup> Also, as Motorola explained in its opening comments, the concept of uniform spreading should be separately defined as a mechanism that uniformly utilizes spectrum over a large population of devices.<sup>9</sup>

The Wi-Fi Alliance agrees with Motorola that the Commission should permit relaxing the DFS thresholds for systems that use antenna gains greater than 0 dBi.<sup>10</sup> The Alliance recognizes that the higher gain antenna systems present the same interference potential to radar systems as do other users based on the same reference EIRP. Thus, the Commission should add a provision

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<sup>7</sup> See, e.g., Comments of Proxim Corp., Comments of Cisco Systems, Inc.; Comments of IEEE 802.

<sup>8</sup> See, e.g., Comments of The Wi-Fi Alliance;

<sup>9</sup> See Comments of Motorola, Inc. at 5. Although Motorola cited one approach (*i.e.*, random channel selection) to uniformly distribute operations among the channels used by the U-NII device, any other method should be allowed.

<sup>10</sup> See Comments of The Wi-Fi Alliance at 7-8.

to its proposed rules in Section 15.407(h)(2) consistent with section 3.1.2 in Annex 2 of recommendation ITU-R Recommendation M.1652. Notably, the test procedures being defined by the informal NTIA working group include both radiated and conducted measurement procedures. Although the final product of that working group has yet to be submitted to the Commission and given adequate public review, any radiated test procedures should include radar signals entering at the peak gain of the antenna for the device under test.

#### **D. Transmit Power Control (“TPC”) Requirements**

Many parties recognized that TPC is being implemented to ensure that the aggregate signal power is 3 dB less than the maximum permitted power, and that there is no need to require power control mechanisms for devices that already transmit with 3 dB less power than the maximum permitted.<sup>11</sup> These parties ask the FCC to only specify a minimum power control range for TPC, and not require use of any particular triggering mechanism. Like Motorola, these parties recognize that minimal regulation brings ongoing equipment design innovation.

The FCC’s proposed regulations implementing TPC and DFS with Radar Detection in the expanded U-NII mid-band were part of a carefully crafted compromise between the FCC, NTIA, DoD, and industry to protect critical government radar systems, and the NPRM addresses only the requirements that apply to the newly expanded mid-band. In this regard, the FCC should

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<sup>11</sup> See, e.g., Comments of Atheros Communications, Inc. at 4-5; Comments of Nokia Inc. at 3. Many comments explain that this approach is fully consistent with new ITU Regulations and the WRC-03 Resolution COM 5/16. According to COM5/16, TPC shall be employed “to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or if [TPC] is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB.” See Resolution COM 5/16, Resolves 7.

reject ARRL's call for the application of TPC in the upper U-NII band at 5.725-5.825 GHz as well outside the scope of this proceeding.<sup>12</sup>

Motorola has requested that any promulgated rules clarify how TPC and DFS interact. For example, if a device lowers its transmit power to below 200 mW EIRP, it should be permitted to raise its DFS threshold by 2 dB.

### **E. Test Procedures**

Many comments seconded Motorola's suggestion that the Commission should utilize the substantial work completed in Europe under the auspices of ETSI regarding the development of conformance testing for the interference avoidance mechanisms, DFS and TPC,<sup>13</sup> as it will help streamline the development of conformance testing in the U.S. Comments also noted that FCC implementation of internationally acceptable conformance test procedures will limit the impact of such testing on equipment costs and speed the development of fully compliant equipment.<sup>14</sup>

### **F. Transition Period**

Following its review of the comments, Motorola agrees with those comments that ask the Commission to tie the transition period start dates to the availability of accepted test procedures for DFS with Radar Detection.<sup>15</sup> Motorola agrees that the FCC's proposal to tie the transition period start dates to the publication of the R&O could lead to a situation where new rules are

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<sup>12</sup> See Comments of ARRL at 10. The FCC should also reject ARRL's other request that U-NII equipment implement DFS to avoid all signals above the specified DFS threshold. See *id.* at 9-10. This is also far beyond the scope of this proceeding and unnecessary in light of the Commission's observations relating to 5 GHz amateur operations. See NPRM at ¶ 19.

<sup>13</sup> See, e.g., Comments of IEEE 802; Comments of Nokia Inc. at 4; and see ETSI EN 301 893 V1.2.2 (2003-06).

<sup>14</sup> See Comments of Proxim Corp. at 6-7; Comments of Cisco Systems, Inc. at 8.

<sup>15</sup> See, e.g., Comments of Agere Systems at 7; Comments of Airespace Inc; Comments of IEEE 802; Comments of the Wi-Fi Alliance at 13-14. Motorola initially supported the language in proposed rule Section 15.37(l).

made effective when there is no mechanism in place by which to receive new FCC equipment authorizations.

### **CONCLUSION**

In light of the overwhelming support for the Commission's plan to expand the available U-NII spectrum, the agency should quickly issue a Report and Order authorizing the proposed operations in accordance with the minor clarifications suggested by Motorola and others. As the FCC and a vast majority of commenting parties recognize, the opening of greater global markets to U.S. manufacturers will benefit many U.S. industries that increasingly rely on unlicensed wireless services. The internationally harmonized spectrum allocation, which offers a global market for unlicensed equipment, will lower end-user equipment costs through increased economies of scale. The sooner the proposed operations are authorized, the sooner these important benefits can be realized.

Respectfully submitted,

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## **Appendix A to Reply Comments of Motorola in ET Docket 03-122**

### **Sharing Analysis of Point-to-Point Links with Radar Systems**

Studies performed in preparation of the US position for WRC, which formed the basis of an agreement between NTIA/DOD/FCC and the wireless industry involving the proposed operations in the NPRM, used unlicensed RF devices operating with omni directional patterns in azimuth.<sup>16</sup> The methodology simulated only access points/base stations, which typically operate in a point-to-multipoint mode, and did not account for situations where a U-NII device may be operating in a point-to-point mode with antenna discrimination in the direction of the radar. This appendix analyzes these point-to-point operations with the NPRM's proposed EIRP of 1 W.

As a baseline, the simulation is repeated using the parameters prescribed in Annex 2 of Recommendation ITU-R M.1652 for the detection thresholds prescribed in the proposed rules.<sup>17</sup> Figure 1 and Figure 2 depict simulation results for the peak interference level over 1000 trials for the radar in each indicated zone.<sup>18</sup> This analysis evaluates Radar C and Radar K from the radar set in ITU-R M.1638.

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<sup>16</sup> See Appendix 2 of Annex 6 to ITU-R Recommendation M.1652.

<sup>17</sup> The agreement reached regarding the U.S. position on 5 GHz wireless access devices were "based upon new information recently explored." See <http://www.ntia.doc.gov/ntiahome/press/2003/5ghzagreement.htm>. Motorola understands that this new information related to less active devices than what was used in the ITU studies; however, no details on the specific value were provided. Thus, this analysis may represent levels of interference higher than what should be expected as it uses the same parameters for active devices found in ITU-R Recommendation M.1652.

<sup>18</sup> The simulations divide the city into three regions indicated by R0, R1, and R2. R0 is the urban zone located at the center of the city with the densest deployment. R1 is the suburban zone, and R2 is the rural zone.

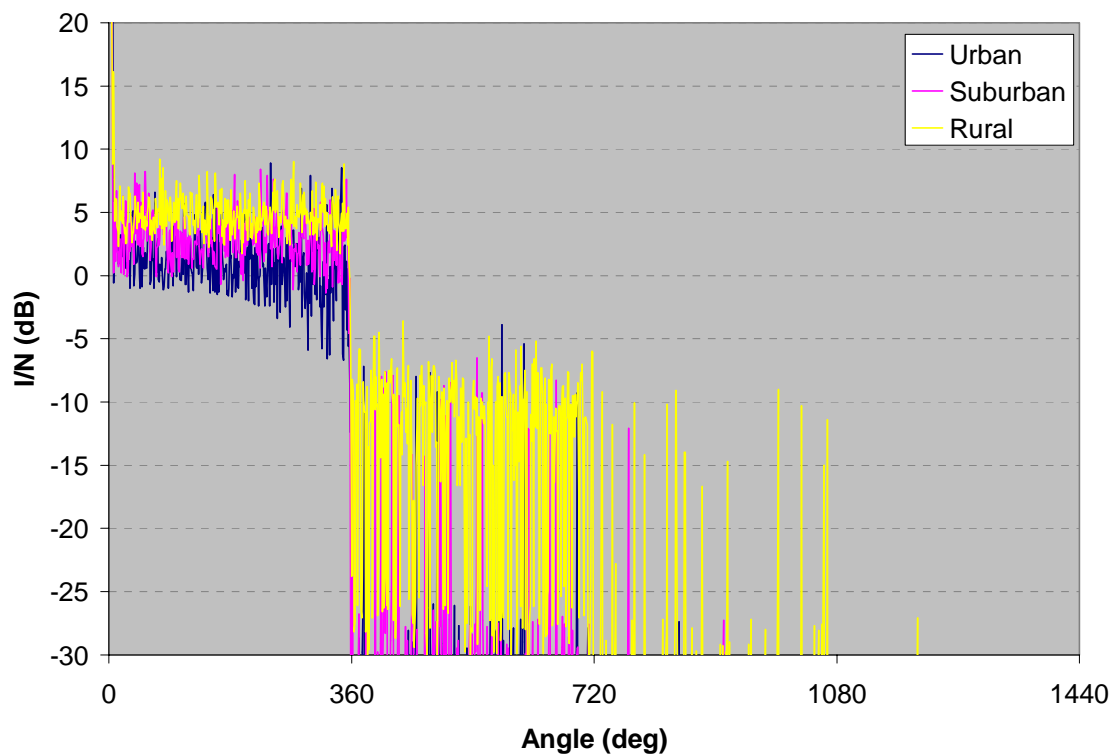


Figure 1: Radar C - Baseline

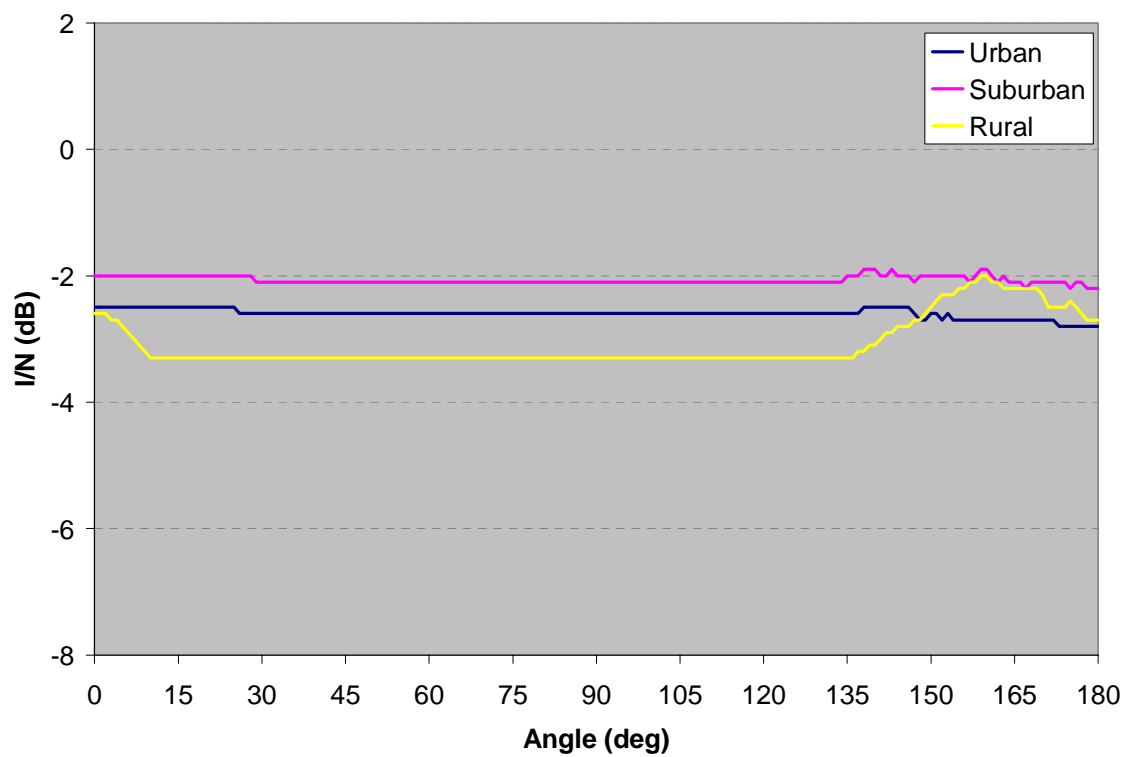
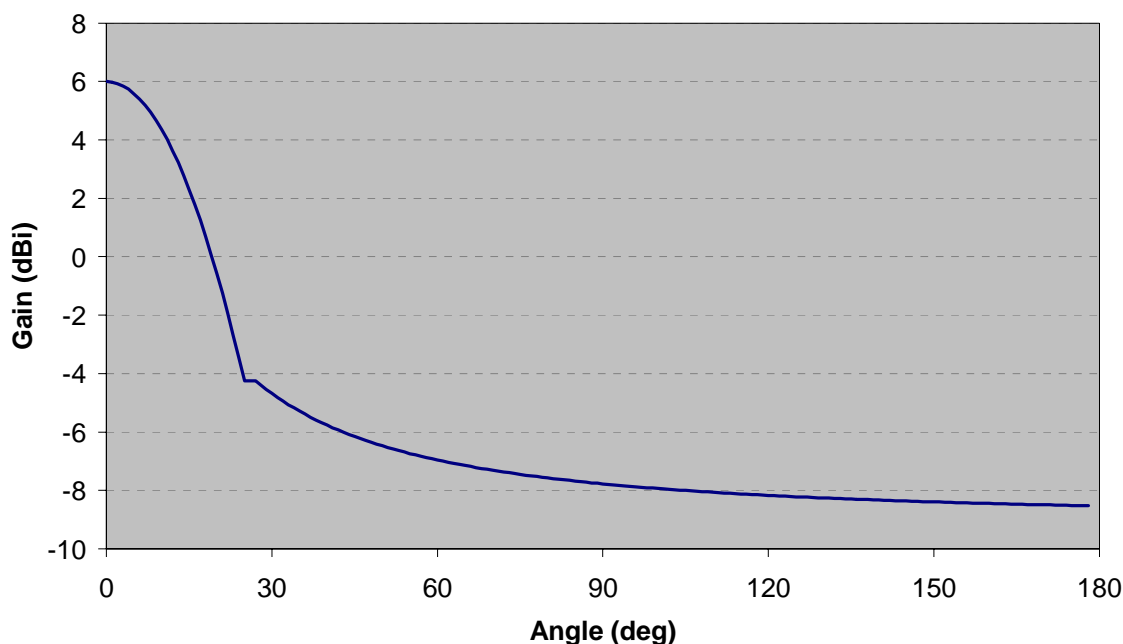


Figure 2: Radar K - Baseline

To evaluate the impact of point-to-point operations, all simulated U-NII devices radiating with 1 W EIRP were given an antenna pattern and associated device pointing direction. The pointing direction was assumed always to be towards the horizon with a random pointing in azimuth (uniformly distributed). The antenna pattern for the U-NII radiator from the boresight angle is the same as prescribed in Appendix 2 of Annex 6 to ITU-R M.1652 and is shown in Figure 3.<sup>19</sup>



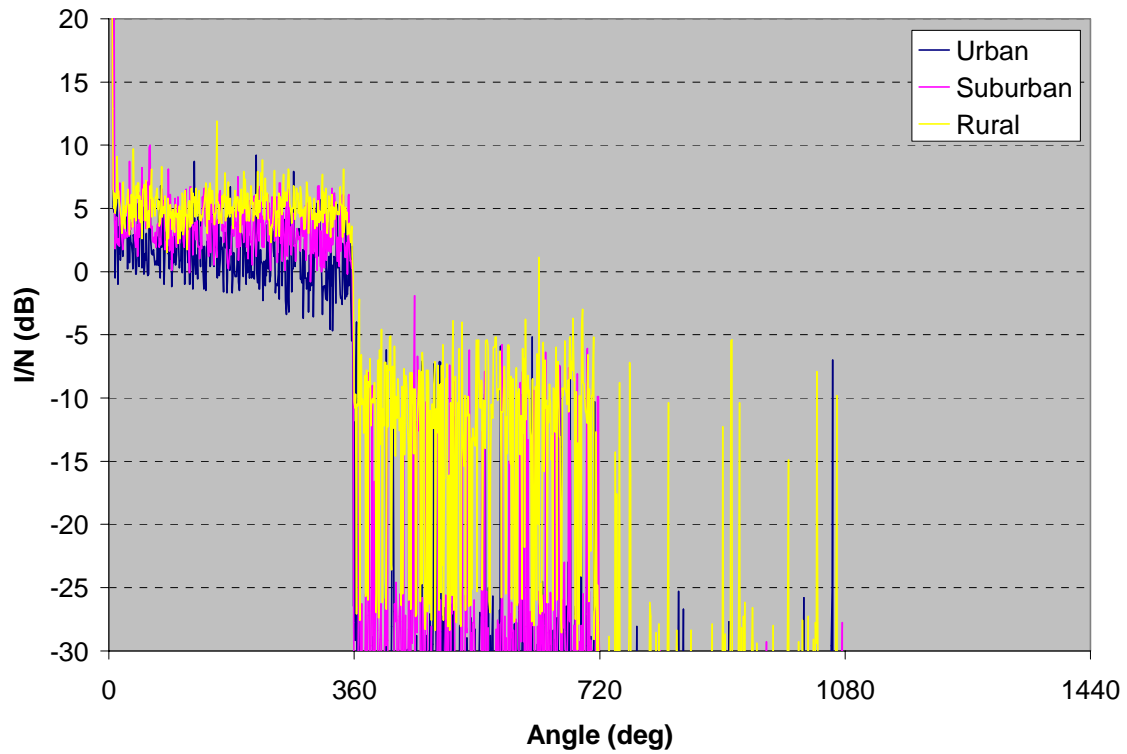
**Figure 3: U-NII antenna pattern from boresight of antenna**

Figure 4 and Figure 5 show simulation results for point-to-point devices with Radar C and Radar K. These simulation results clearly show that devices operating in a point-to-point mode will react with the DFS mechanism in a similar manner to that of point-to-multipoint devices with omni-directional radiation patterns.

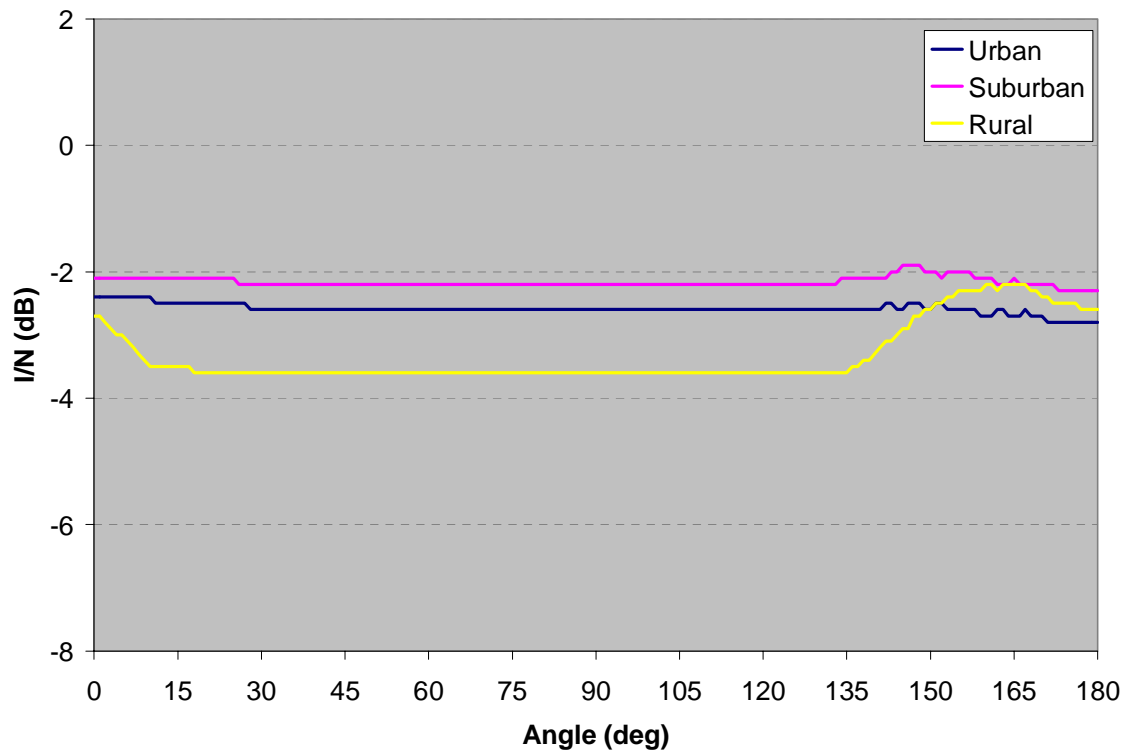
Thus, point-to-point operations should continue to be permitted in the 5250-5350 MHz band and also permitted in expanded U-NII mid band at 5475-5725 MHz, as the DFS mechanism will operate in the same manner (as point-to-multipoint) and provide the same level of protection to incumbent radar systems.

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<sup>19</sup> The original analysis applied the same general antenna pattern for the difference in the elevation between the radar and the U-NII device. This point-to-point analysis applies the antenna pattern to the angle defined by the pointing direction of the U-NII device and a vector from the radar under consideration to the U-NII device.



**Figure 4: Radar C – All 1 W Devices with directional antennas**



**Figure 5: Radar K – All 1 W Devices with directional antennas**